A New Way to Explore Space

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Three Major Takeaways

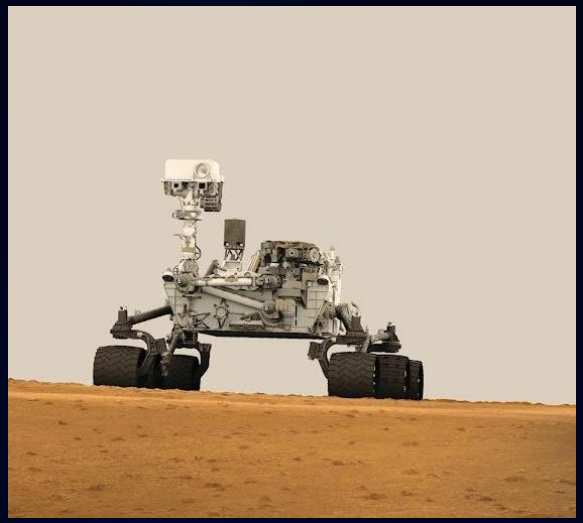
Why Pre Deployment is the Best Strategy for Exploration

Why we will First Go to the Moon, then on to Mars

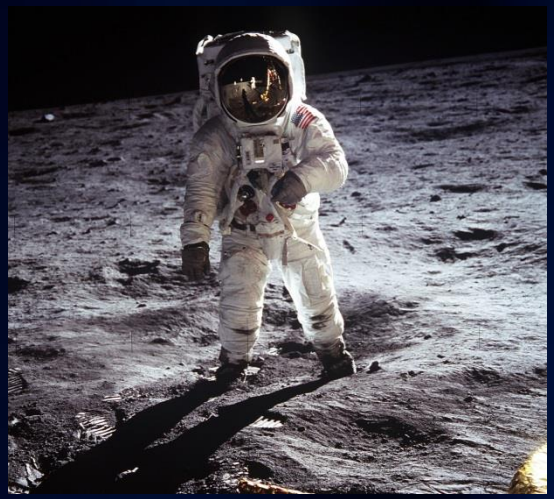
Why Autonomy and Robotics is Key

We have three campaigns of exploration underway

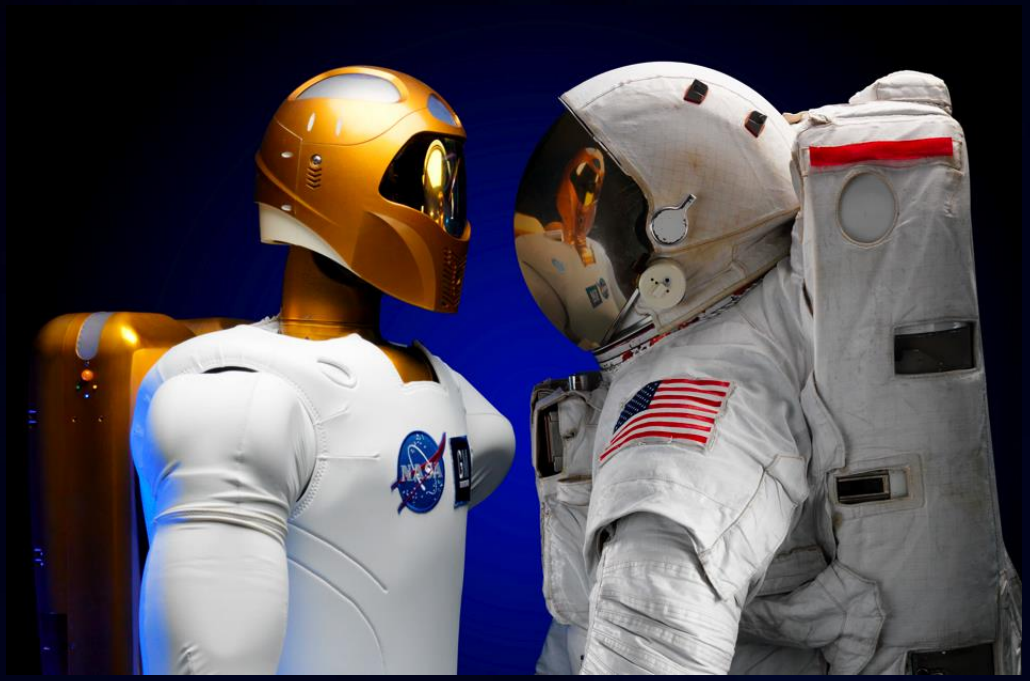
Telescopes



Robots



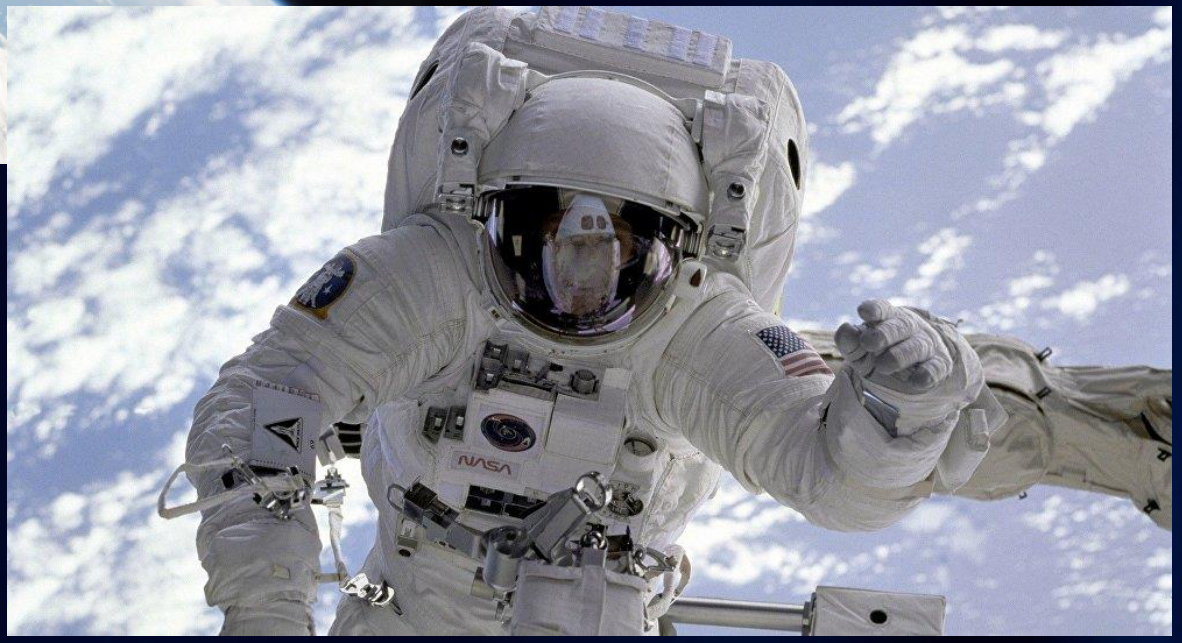
Astronauts



Instead of thinking robots or humans…

… think robots and humans.


JAPAN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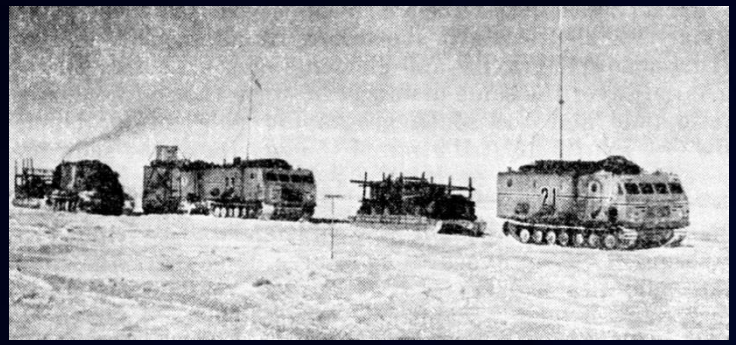
Columbus, taking everything with him

Apollo, taking everything with them

Why Pre Deployment?

Long duration exploration is a matter of logistics.



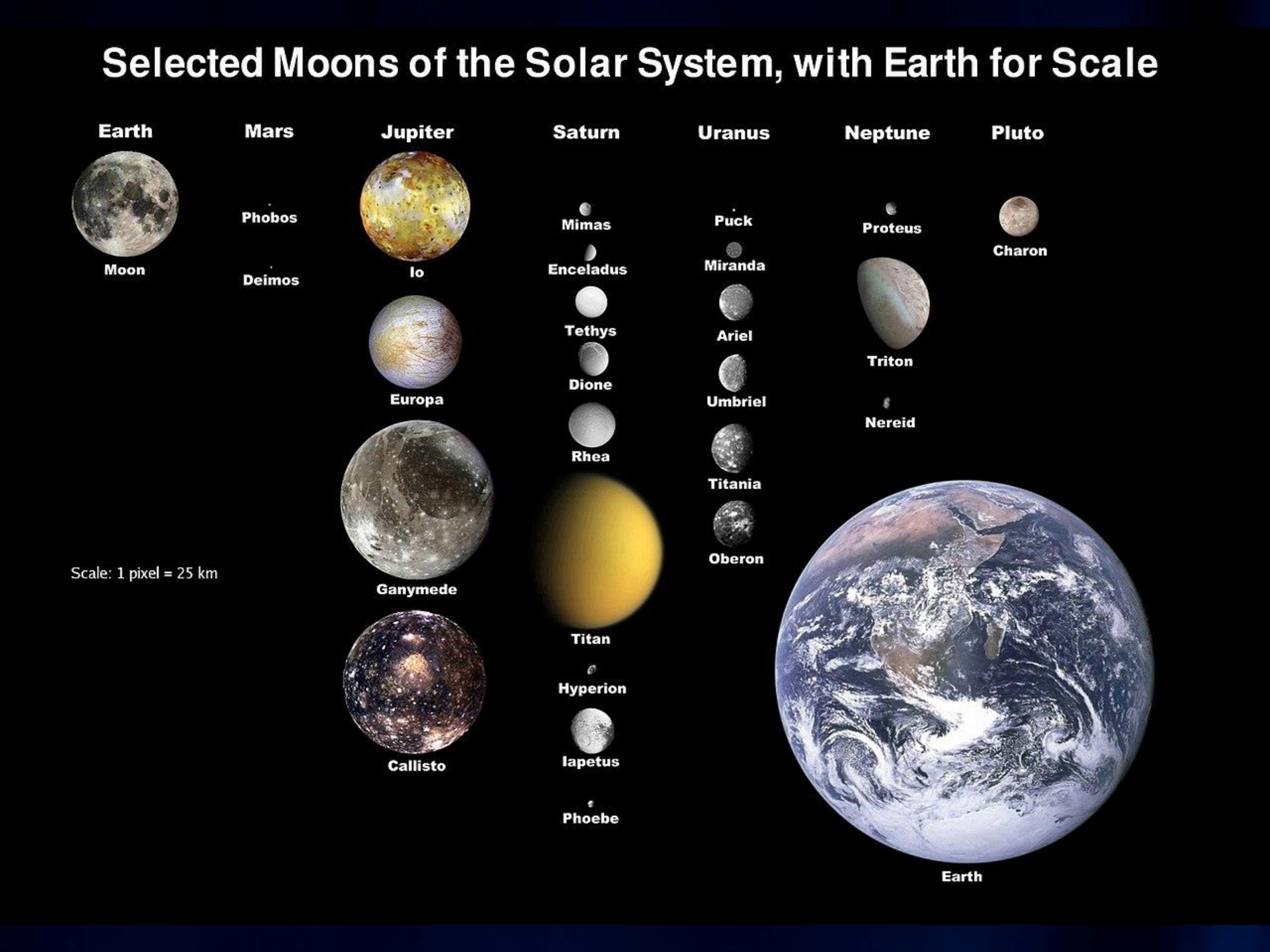
Antarctic missions are long duration, and require substantial logistics

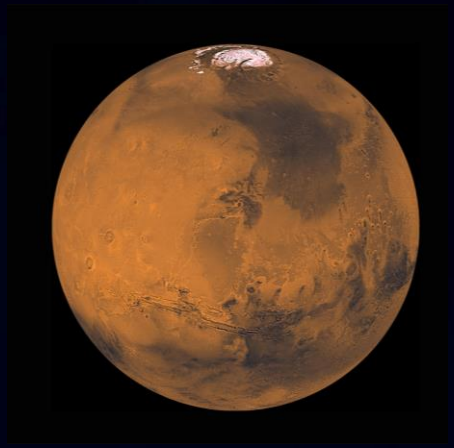
The Martian

Gear was pre deployed….

…….. then the humans launched.

Selected Moons of the Solar System, with Earth for Scale



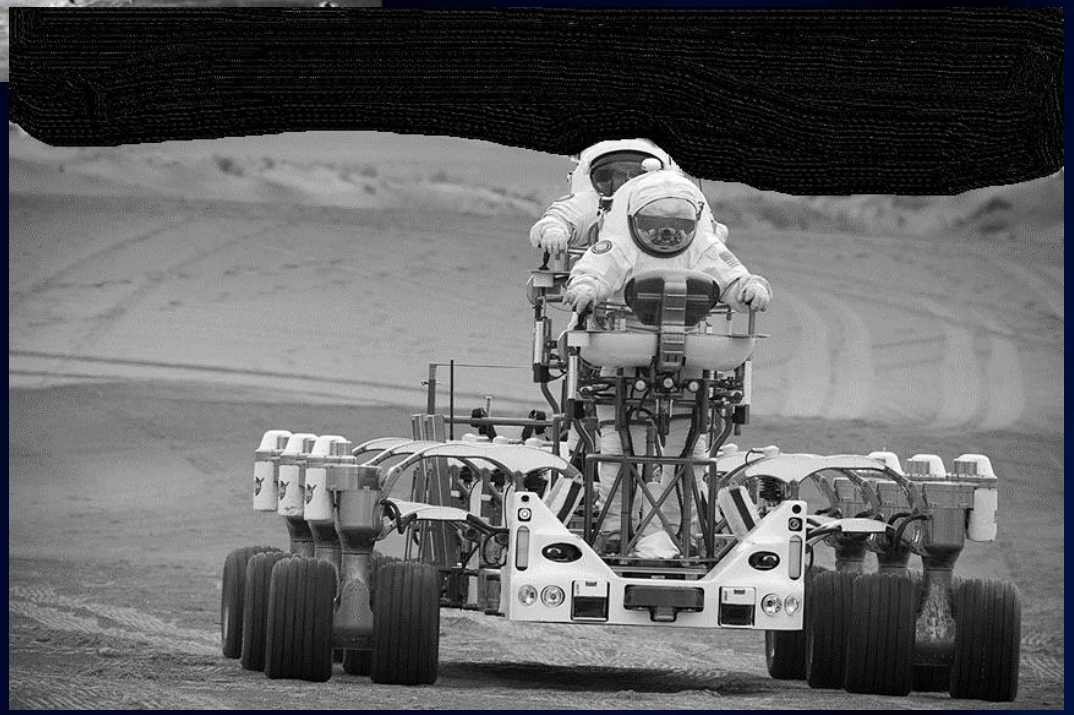


Mars

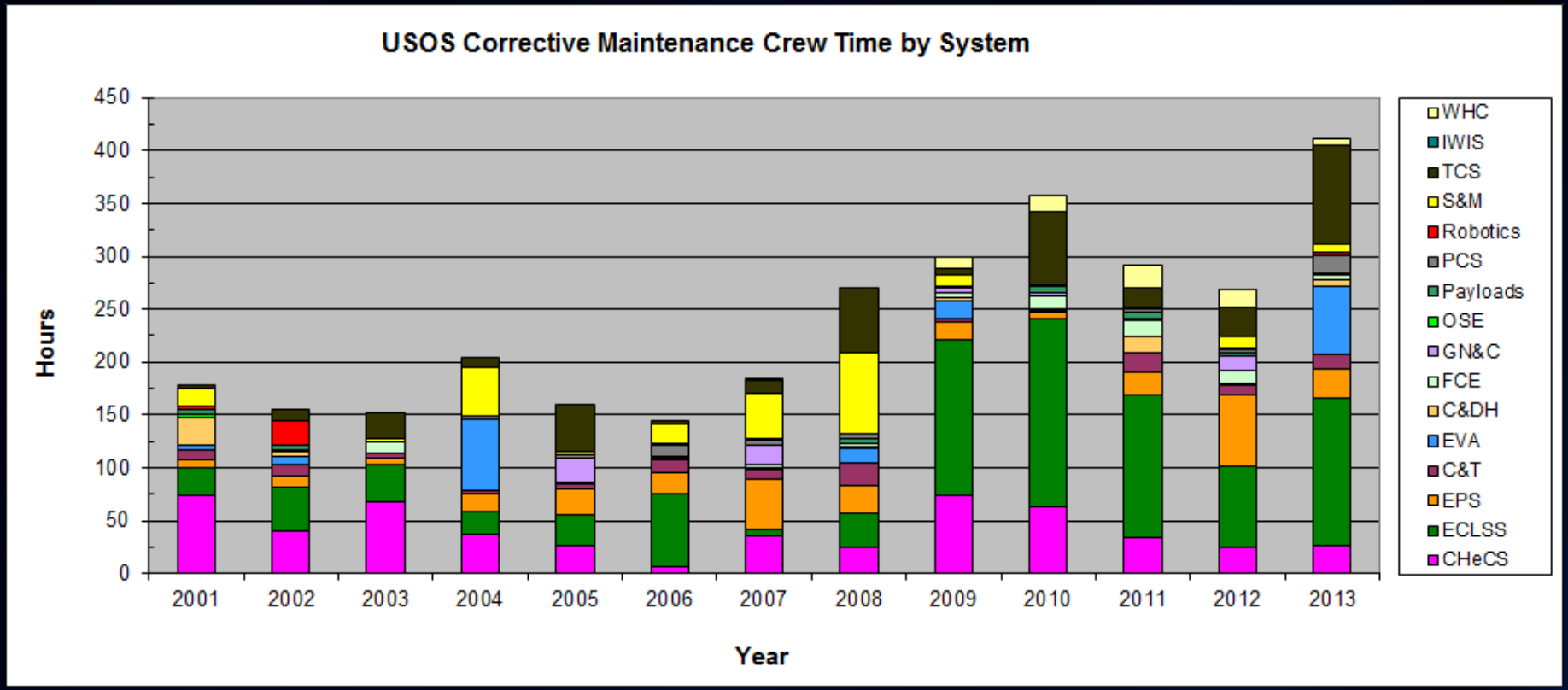
Europa
(Jupiter)

Enceladus
(Saturn)

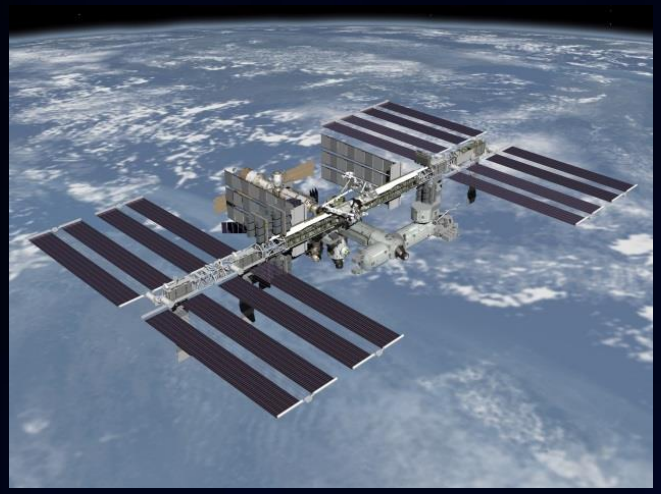
Practice on the Moon



ISS Maintenance

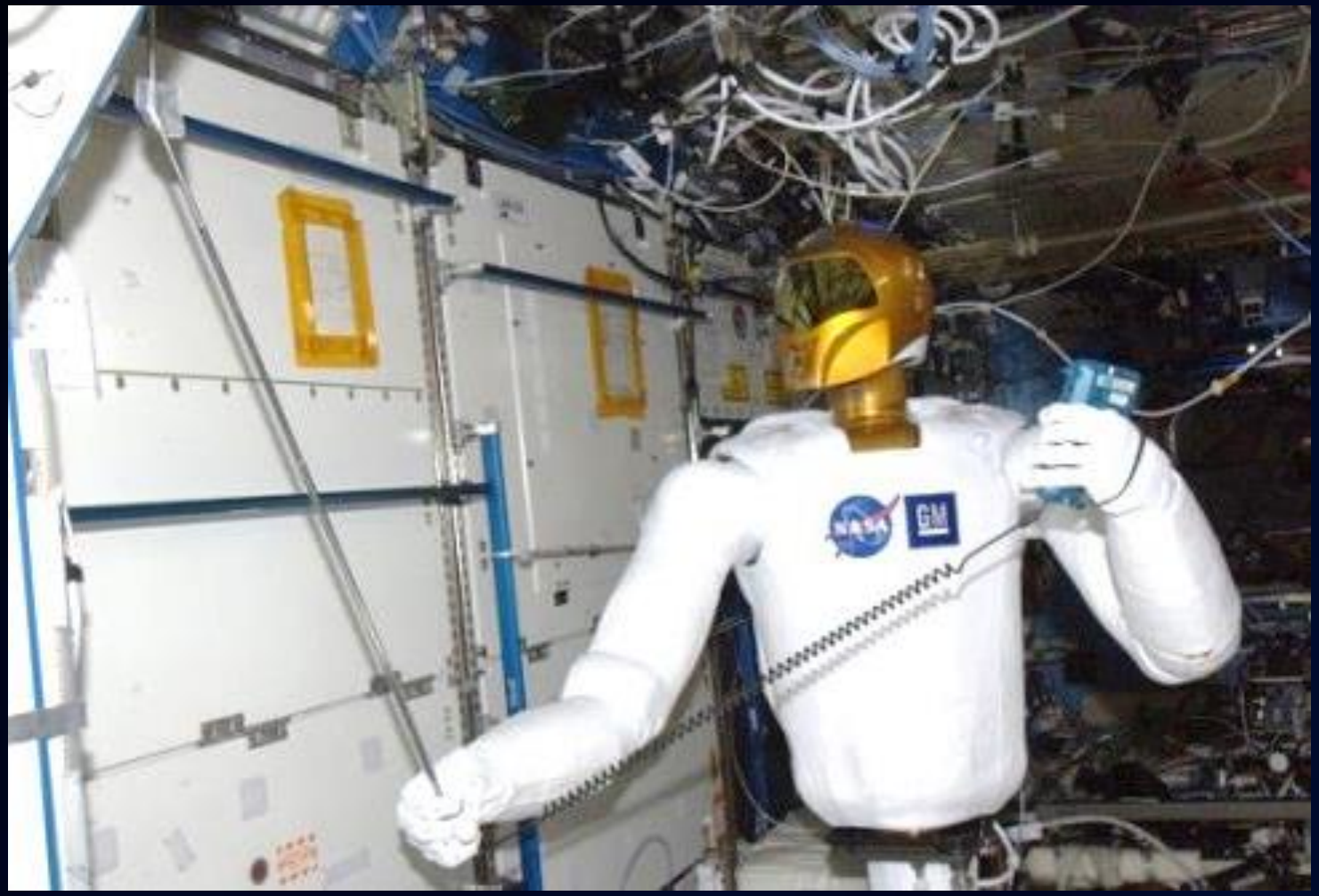


ISS Subsystem Availability

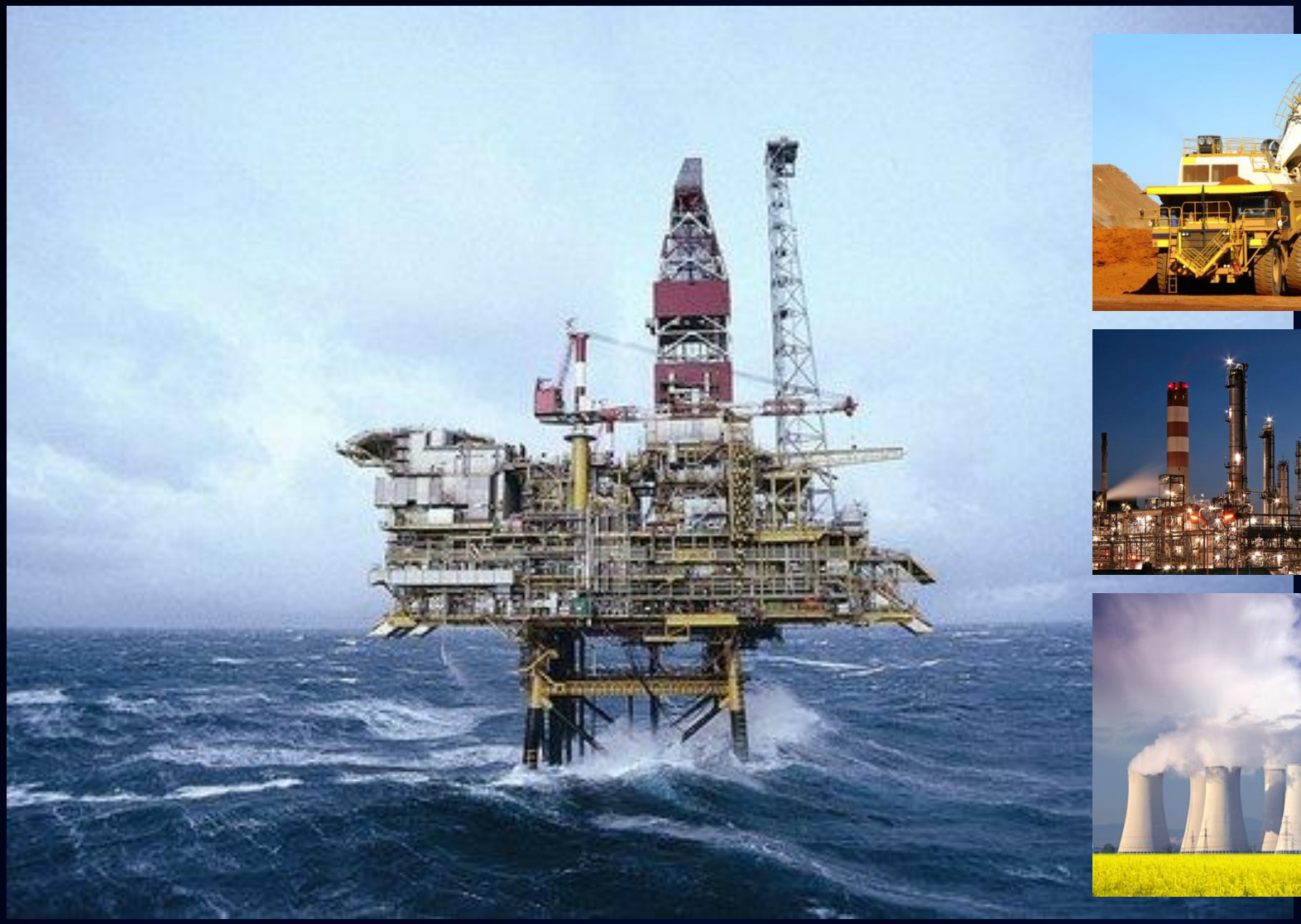


Yearly Average fA (%) by Function							
Functions	2015	2016	2017	2018	2019	2020	Overall Average
WPA	99.4	93.6	74.1	55.2	54.6	26.1	67.2
MCA	94.8	86.1	74.1	63.6	57.1	49.4	70.8
CDRA	95.8	86.8	75.3	69.0	63.4	53.9	74.0
OGA	97.2	84.0	73.4	70.3	67.9	76.1	78.2
Express	98.4	93.4	86.5	79.5	72.3	65.7	82.6
INTRAMODULE	97.9	93.8	88.6	82.2	75.7	65.5	84.0
Ku-Band	98.3	96.4	92.1	87.1	82.0	76.9	88.8
Usable Power	98.9	96.9	94.1	90.8	87.0	82.3	91.7
UPA	99.6	98.5	94.2	87.7	87.5	88.7	92.7
VES	99.0	95.3	90.1	89.5	90.2	92.3	92.7
VRS	98.9	96.7	93.9	90.5	91.3	93.5	94.1
Internal/External Video	99.7	98.9	97.2	94.5	91.6	89.0	95.1
EPS	99.9	99.8	99.7	99.2	93.9	87.6	96.7
WRM	99.0	98.0	98.1	95.5	96.6	95.3	97.1
C&T	99.8	99.3	98.6	97.5	96.5	94.7	97.7
CDRA Valves	98.9	95.7	96.2	98.4	99.6	99.7	98.1
NGTS	99.9	99.8	99.7	99.2	98.4	97.9	99.2
ITCS	99.6	99.5	99.3	99.0	98.9	99.1	99.3
Internal Power	100.0	100.0	99.8	99.5	98.7	97.6	99.3
ACS	99.5	99.5	99.2	99.1	99.1	99.3	99.3
ITCS Coldplates	99.8	99.6	99.4	99.3	99.2	99.2	99.4
SDS	99.9	99.7	99.2	99.1	99.4	99.5	99.5
TCCS	100.0	99.8	99.7	99.5	99.4	99.2	99.6
THC	100.0	99.5	99.9	99.9	98.5	99.9	99.6
AD	100.0	99.9	99.9	99.7	99.8	99.6	99.8
SD	100.0	99.9	99.9	99.8	99.8	99.7	99.9
FDS	99.9	99.9	99.8	99.8	99.8	99.8	99.9
Other	99.9	99.9	99.9	99.9	99.9	99.8	99.9
ARIS	100.0	100.0	99.9	99.9	99.8	99.9	99.9
Attitude Translation	100.0	100.0	100.0	100.0	99.9	99.7	99.9
Internal Audio	100.0	100.0	100.0	99.9	99.8	99.8	99.9
Caution & Warning	100.0	100.0	100.0	99.9	99.8	99.9	99.9
STRUCT	100.0	100.0	100.0	99.9	99.9	99.9	100.0

ISS Robotic Maintenance



Terrestrial Applications



Main Points

- We are the first generation with the technology to pre deploy.
- Pre deploying assets in orbit and on the surface of and practice this on the Moon.
- Stuff breaks in space, even if you leave it alone, so leave some robots behind as caretakers.

Questions?